

Claims

1. A state changeable memory alloy capable of changing from a first state to a second state in response to the input of energy, said alloy having a first detectable characteristic when in said first state and a second detectable characteristic when in said second state, said alloy further characterized in that the first state comprises a single phase and said second state comprises either (1) a single phase having the same composition as said first state or (2) a plurality of phases which have substantially similar crystallization temperatures and kinetics.

2. An alloy as in claim 1, which comprises a chalcogenide material.

3. An alloy as in claim 1, which comprises at least three elements.

4. An alloy as in claim 1 which comprises Te, Ge and Sb.

5. An alloy as in claim 1 which is capable of changing from said first state to said second state in response to the input of optical energy.

6. An alloy as in claim 1, which is capable of changing from said first state to said second state in response to the input of electrical energy.

7. An alloy as in claim 1, which is capable of changing from said first state to said second state in response to the input of thermal energy.

8. An alloy as in claim 1, wherein said first state is an amorphous state and said second state is a crystalline state.

9. An alloy as in claim 1, wherein said first and second detectable characteristics are selected from the group consisting of reflectivity, band gap, electrical resistance, optical absorption, magnetic susceptibility and thermal conductivity.

10. A congruent state changeable, chalcogenide, optical memory material capable of existing in at least an amorphous state and a crystalline state, said material

T  
N  
P  
a  
K  
J  
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Claims 9+10  
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5 having a first detectable characteristic when in the crystalline state and a second detectable characteristic when in the amorphous state and being capable of undergoing a congruent state change upon the application of projected beam energy thereto, said material being of the composition:



10 a, b and c being expressed in atomic percentages and selected such that, when said material is in the crystalline state, and it includes a major portion which has the same composition as the material has when in the amorphous state and a minor portion which has the composition:



15 (d, e and f being expressed in atomic percentages), wherein the differences between a and d, b and e, and c and f respectively, total no more than 16, atomic percent.

11. The material of claim 10 wherein a is from 49 to 53, b is from 36 to 40 and c is from 9 to 13.

12. The material of claim 10 further comprising a third portion of varying composition.

20 13. The material of claim 10 wherein the material switches from the amorphous to the crystalline state upon the application of projected beam energy thereto.

Claim 14

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14. The material of claim 13 wherein data is recorded upon the material by switching it from the amorphous to the crystalline state.

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15. The material of claim 13 wherein the material is reversibly switchable between the amorphous and crystalline states by application of projected beam energy thereto.

Claim 17  
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16. The material of claim 15 wherein data is recorded upon the material by switching it from the amorphous to the crystalline state and erased from the material by switching it from the crystalline to the amorphous state.

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17. The material of claim 16 wherein the projected beam energy is supplied by a laser.

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18. The material of claim 17 wherein the first detectable property is the optical reflectivity of the material in the amorphous state and the second detectable property is the optical reflectivity of the material in the crystalline state.

<sup>21</sup>  
~~19~~. The material of claim <sup>20</sup>~~18~~ wherein the ratio between the first and second detectable states (relative reflectivity) at the threshold record laser power is between <sup>2</sup>~~B~~ and <sup>3</sup>~~B~~.

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~~20~~. The material of claim <sup>21</sup>~~19~~ wherein the carrier to noise ratio is at least 45db at the threshold record power.

<sup>14</sup>  
~~21~~. The material of claim 10 wherein the congruent state change temperature is at least 200°C.

<sup>17</sup>  
~~22~~. The material of claim <sup>15</sup>~~14~~ wherein the material has a usable upper frequency of at least 6 Mhz.

<sup>9</sup>  
~~23~~. The material of claim 1 wherein said material is substantially entirely crystalline when in said crystalline state.

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20 24. In an optical data storage memory device comprising a substrate, a dielectric first encapsulating layer on the substrate, a memory layer on the dielectric first encapsulating layer, and a dielectric second encapsulating layer atop the memory layer, the improvement wherein the memory layer is a non-ablative, congruent state

change memory layer capable of existing in at least an amorphous state and a crystalline state and formed of a material having the composition:



5 a, b and c being expressed in atomic percentages and selected such that, when said material is in the crystalline state, it is substantially entirely crystalline and includes a major portion which has the same composition as the material has when in the amorphous state and a minor portion which  
10 has the composition:



(d, e and f being expressed in atomic percentages) wherein the differences between a and d, b and e, and c and f, respectively, total no more than 16.

15 25. A state changeable memory alloy capable of changing from a first state to a second state in response to the input of energy, said alloy having a first detectable characteristic when in said first state and a second detectable state when in said second state, said alloy  
20 having the general formula  $\text{Te}_{50}(\text{GeX})_{50}$  wherein X is Sb, Sn or Bi, said alloy further characterized in that the first state comprises a single phase and said second state comprises either (1) a single phase having the same composition as said first state or (2) a plurality of phases which have

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substantially similar crystallization temperatures and kinetics.

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5 detectable state when in said second state, said alloy having the general formula  $\text{Te}_{50}(\text{GeX})_{50}$  wherein X is Sb, Sn or Bi, said alloy further characterized in that the first state comprises a single phase and said second state comprises either (1) a single phase having the same composition as said first state or (2) a plurality of phases which have substantially similar crystallization temperatures and kinetics.